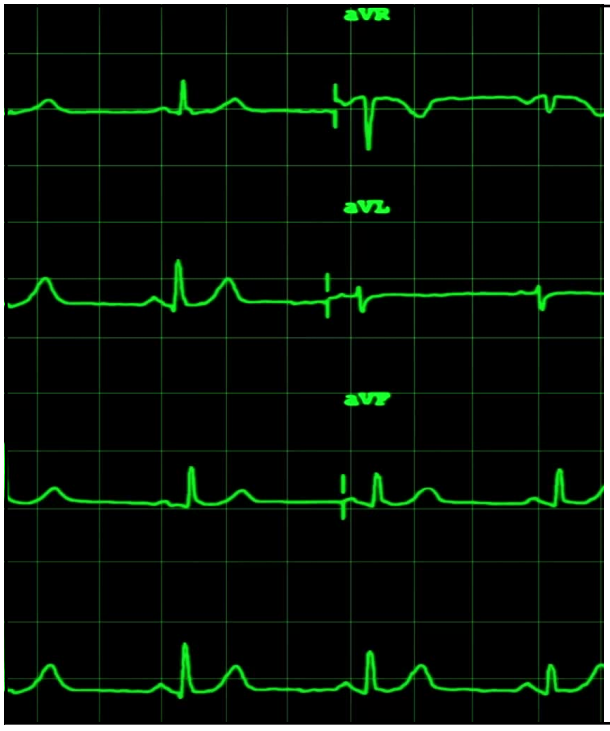
Achy Breaky Heart: A Look At Stress-Induced Cardiomyopathy

Lee Ellen Brunson, MHS, MLS(ASCP)^{CM}
LSU Health Shreveport
CLPC Seminar – Spring 2025

1



Objectives

1. Describe the clinical presentation of stress-induced cardiomyopathy.
2. Discuss suspected causes of stress-induced cardiomyopathy.
3. Explain how symptoms, testing, and the exclusion of other conditions are used to diagnose and monitor this condition.

2

Case Study – background

- A 67-year-old female presents to the ED with severe substernal chest pain that began suddenly about 30 minutes prior.
- A few hours earlier in the day, she had been swimming at the beach with her two young grandchildren.
- The current began to pull the children away from the shore, and the patient desperately held both children to keep their heads above water.
- A nearby swimmer came to the family's aid and helped get them safely back to shore. They went home and resumed normal activities, until the patient began to experience alarming chest pain and shortness of breath.

3

Case Study – vital signs and exam

- She describes the pain as "crushing" and says that it radiates to her left shoulder and jaw.
- She also has nausea and profuse cold sweating.
- Temp: 98.2°F
- BP: 142/90 mmHg
- HR: 105 bpm
- RR: 22 breaths/min
- O_2 Sat: 97% on room air

4

HEART ATTACK!!

5

Case Study – past medical history

- Postmenopausal
- Non-smoker
- Mild hypertension
- No known coronary artery disease
- No diabetes

6

Case Study – results synopsis

- Lab results:
  - Troponin – mildly elevated
  - CK-MB – mildly elevated
  - BNP – moderately elevated
  - CRP – mildly elevated
- Cardiac imaging results:
  - EKG: ST-segment elevation in leads V2–V4, T-wave inversion in V3–V6
  - Echocardiogram: Apical ballooning of the left ventricle, ejection fraction (EF) - 40%, no significant wall motion or valve abnormalities
  - Coronary angiography: No significant coronary artery obstruction, coronary flow is intact

7

DIAGNOSIS?

HEART ATTACK? NO

STRESS-INDUCED CARDIOMYOPATHY? YES

8

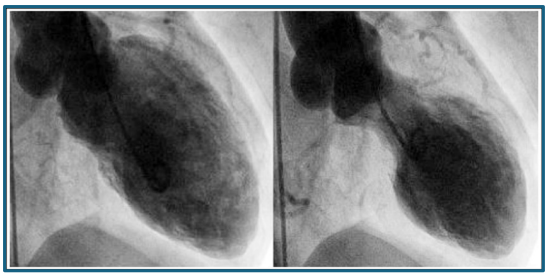
What is stress-induced cardiomyopathy?

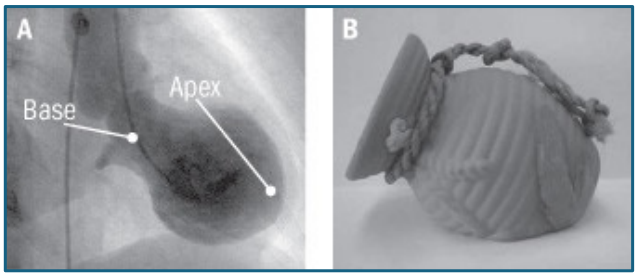
- AKA Broken Heart Syndrome, Happy Heart Syndrome, Takotsubo Syndrome (TS), Takotsubo cardiomyopathy
- An often-reversible heart condition that occurs following intense emotional or physical stress
- Mimics the symptoms of an acute myocardial infarction (AMI) or heart attack
- Diagnosis is dependent on cardiac imaging as well as lab results
- Usually resolves with supportive care but may also have long-term consequences

9

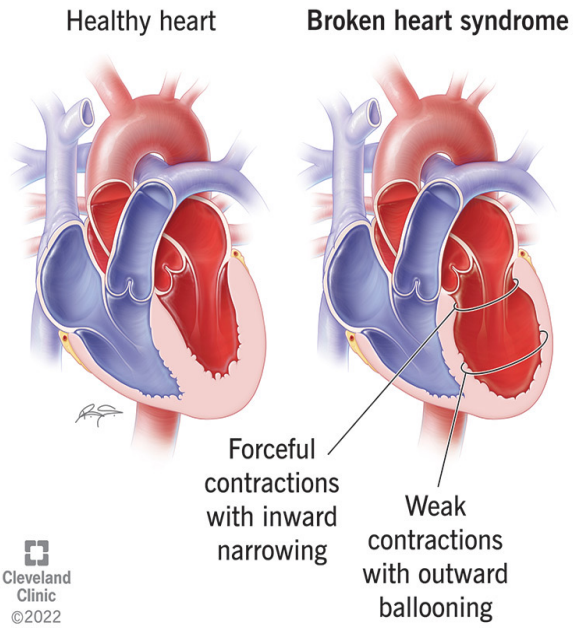
Background

- 1990s: "Takotsubo Syndrome" coined by Japanese researchers who noticed 'ballooning' of the left ventricle in five patients with clinical features of AMI but had no obstructive coronary heart disease
- Named because of ventricle resemblance to Japanese octopus trap (tako = octopus, tsubo = pot)





10



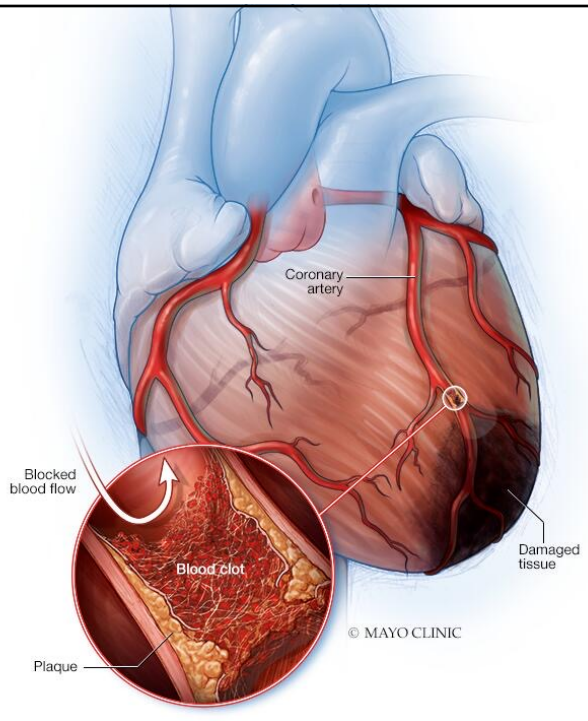
What happens during Takotsubo Syndrome?

- Process not well-understood
- An emotionally or physically stressful event causes hyperactivity of the sympathetic nervous system.
- Increased stress hormone production results in acute myocardial dysfunction, which causes the base of the left ventricle to bulge out and weaken its pumping ability – “apical ballooning”

11

What happens during a heart attack?

- An artery that sends blood and oxygen to the heart becomes narrowed by fatty, cholesterol-containing deposits called plaques.
- Plaque ruptures and causes damage to vessel wall, resulting in the formation of a blood clot, which can block arteries and cause tissue in the heart muscle to die.



12

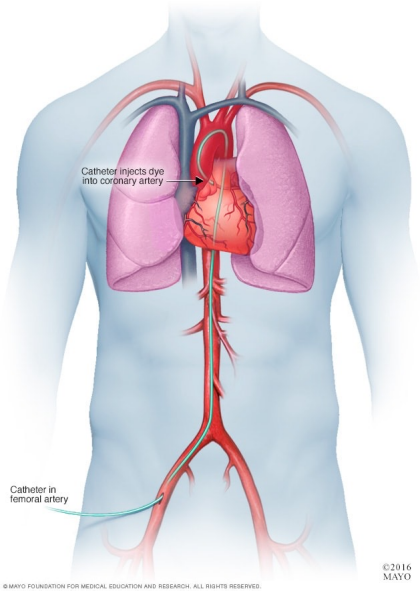
Investigations

- **Cardiac and inflammatory biomarkers:** troponin, CK-MB, BNP, CRP
- **Electrocardiogram (EKG):** checks heart rhythm and electrical activity using electrode patches
- **Echocardiogram ("echo"):** ultrasound of the heart that provides moving pictures and information about heart structure and function; also measures volume of blood pumped out
- **Coronary angiogram ("heart cath"):** uses x-rays and contrast dye injected into the heart to look for blocked blood vessels in the heart
- **Cardiac magnetic resonance imaging (MRI):** uses magnets and radio waves to create high-quality images of the heart and its internal structures

13

Heart catheterization

- "Heart cath"
- Invasive imaging procedure used to assess heart function and diagnose cardiovascular conditions
- A thin tube is inserted into a major artery and guided into the heart, where dye is injected
- Can evaluate heart structure, heart muscle function, and vessel blockages
- Can also be used to deliver treatment



14

Takotsubo Syndrome vs Acute Myocardial Infarction

Feature	Takotsubo Syndrome	Acute Myocardial Infarction
Troponin	Mild-moderate rise	Marked elevation
CK-MB	Mild elevation	Marked elevation
BNP	Often higher relative to troponin	Elevated, but proportionately so
CRP	Normal-mildly elevated	Moderate-marked elevation
Electrocardiogram	ST-segment elevation, T-wave inversion (mimicking AMI)	ST-segment elevation typical
Echocardiogram	Apical ballooning or other atypical patterns	Regional wall motion abnormalities
Coronary Angiogram	Normal, unobstructed arteries	Artery blockage(s) present
Trigger	Often emotional or physical stress	Often atherosclerosis
Prognosis	Usually reversible in day-weeks	Risk of acute heart damage

15

Epidemiology of Takotsubo Syndrome

- Increasing in incidence
  - Greater awareness and detection
  - Rising prevalence of modern life stressors
- Accounts for 2-3% of all patients presenting with acute coronary syndrome
- Characteristically affects women in the 6th decade of life
- ~10% of cases are men and younger women
- Genetic predisposition may exist
- Other risk factors: obesity, smoking, hypertension, dyslipidemia, diabetes, psychological disorders, malignancy, and others.

16

A shift in thinking…

- Had previously been viewed as an interesting anomaly that ran a benign course
- Is now known that patients with Takotsubo Syndrome have outcomes that are considerably worse than the general population
  - In-hospital mortality rate comparable to AMI
  - After acute event, TS patients ~6% more likely to die of any cause, and ~10% more likely to experience major adverse cardiac event
- 1 in 8 TS patients will experience a repeat TS episode within 5 years of the first TS event
- Many TS patients report significant morbidity after the TS event: dyspnea, lethargy, palpitations, fleeting chest pains

17

Clinical features of Takotsubo Syndrome

- Rapid-onset chest pain, dyspnea, and EKG changes reflecting an acutely stressful cardiac event
- Usually transient but can recur, even years later
- A major stressful event is thought to bring about TS, but ~1/3 of patients do not acknowledge an identifiable stressor.
- Most patients recover heart function within four weeks.
- In extreme circumstances, 1 in 5 patients may experience severe heart failure, cardiogenic shock, or arrhythmias requiring hemodynamic support devices or ventilation support.
- 1 in 25 patients die.

18

Diagnostic Criteria for Takotsubo Syndrome

- **Diagnosis of exclusion**; presently, no specific diagnostic test or biomarker
- Challenging because TS so closely resembles a heart attack
  - Coronary angiogram required to confirm diagnosis
  - Immediate cardiac imaging needed because of rapid normalization of left ventricle
  - TS *can* coexist in the presence of coronary artery disease
- Hallmark of TS: reversibility in heart function within hours, days, or weeks
- Most widely used diagnostic criteria are those from Mayo Clinic, but other groups have proposed slightly different criteria

19

Two types of Takotsubo syndrome

- **Primary TS** – when symptoms of myocardial damage are the reason for hospitalization
- **Secondary TS** – seen in patients hospitalized for some other condition, which acts as the triggering stressor

20

Takotsubo patients: men vs. women

- Studies have shown that TS patients with an emotional stressor are more likely to be female, present with chest pain, and have better outcomes.
- TS patients with a physical stressor are more likely to be men, have comorbidities, present with syncope and dyspnea, and have acute complications.

21

Emotional stressors

- Anxiety
- Depression
- Domestic violence
- Receiving bad news (such as a diagnosis of cancer)
- Car or other accident
- Unexpected loss, illness, or injury of a close relative, friend, or pet
- Relationship conflicts
- Fierce argument
- Financial loss
- Intense fear
- Public speaking
- Surprise party or other sudden surprise

Physical stressors

- Severe pain
- Sudden drop in blood pressure
- Serious illness, surgery, or medical procedure (e.g., cardiac stress test)
- Infections
- Intracranial hemorrhage
- Pheochromocytoma
- Epilepsy
- Asthma
- Chronic obstructive pulmonary disease (COPD)
- Endoscopies
- Cardioversions
- Cancer

22

Link to cancer

- Study showed that a substantial number of TS patients show an association with malignancy.
- Prevalence of malignancy in TS is higher than in acute coronary syndrome.
- History of malignancy might increase risk for TS, so appropriate screening for malignancy should be considered in these patients.

https://doi.org/10.1161/JAHA.118.010881

23

Pathophysiology

- Underlying cause of Takotsubo Syndrome is elusive and still under investigation, so diagnosis and treatment can be challenging.
- Several proposed mechanisms:
  - Catecholamine release
  - Inflammatory response
  - Hormonal factors
  - Genetic predisposition
  - Combination of several mechanisms

24

Pathophysiological progression

1. Triggering event
2. Acute phase (hours to days)
   - Catecholamine surge
   - Myocardial stunning
   - Wall motion abnormalities
   - EKG changes and biomarker elevation
3. Subacute phase (days to weeks)
   - Inflammatory response
   - Beginning of contractile recovery
4. Recovery phase (weeks to months)
   - Resolution of wall motion abnormalities
   - Normalization of cardiac function

25

Treatment of Takotsubo Syndrome

- No standard treatment
- Often very similar to treatment for heart attack
- Depending on presence/severity of heart damage
  - Beta blockers
  - ACE inhibitors
  - Diuretics
- In the acute setting: supportive care and treatment of complications like heart failure, arrhythmia, or left ventricular thromboembolism
- Long-term management: treat associated risk factors and any underlying condition(s); psychological support often beneficial.

26

Prevention

- Stress management
- Cardiovascular health maintenance
- Medical risk management for those who've already had TS
- Avoid triggers

27

References

- *J. Clin. Med.* **2023**, 12, 125. https://doi.org/10.3390/jcm12010125
- *Circulation.* **2022**, 145, 13. https://doi.org/10.1161/CIRCULATIONAHA.121.055854
- *J Am Heart Assoc.* **2019**, 8:e010881. https://doi.org/10.1161/JAHA.118.010881

28

Questions? Comments? Suggestions? Get in touch!

Lee Ellen Brunson
LeeEllenBrunson@lsuhs.edu
(318)813-2913

29